

3/RTS

10/505293  
DT05 Rec'd PCT/PTQ 21 AUG 2004

WO 03/071752

PCT/SE03/00160

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## **Method and system for relayed mobile IP services in a telecommunication system**

### ***Technical field of the invention***

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This invention generally relates to a method and system for an Internet Protocol (IP) based service in mobile telecommunication systems. More in detail, the invention enables a mobile communication terminal to be used as a point-to-point communication means without interference or control by an operator.

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### ***Background of the invention***

The Internet offers access to information sources world-wide and it has turned out to be the perfect tool for retrieval of all kinds of content, irrespective of whether the information content is audio or graphics. Typically we do not expect to benefit from the Internet and information found and retrieved from there until we arrive at some familiar point, such as in the work office, in school or in front of a computer terminal at home. The increasing number and variety of wireless devices offering Internet Protocol (IP) based connectivity, such as mobile communication terminals, handheld computers, etc, are supposed to change our perceptions about the Internet in a near future.

In order to fully understand the contrast between current realities of IP connectivity and future possibilities, the transition towards mobility that has occurred in telephony over the past decade is to be considered. Seen from both a technical and financial perspective, setting up a functional mobile telecommunication network is a complicated task that requires a major initial investment, as is the case also for other kinds of telecommunication networks based on other access technologies, like for instance WLAN, IR, Bluetooth, etc. Only a few operators in each country are able to manage such an investment, and the investment is usually based on all kinds of pro-

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vided capital including both venture capital and long-term loans from national banks. The operators, due to considerable amounts of instalments and interests on their loans, are forced to charge the subscribers to communication services sufficiently in order to get receipts that correspond to their initial and running expenses.

5 This makes millions of mobile telephony subscribers in most regions pay high amounts for their accessibility and usage of state of the art communication technologies.

Not only the major initial investment in hardware, such as radio base stations,  
10 physical connection links, routers, antennas and other equipment is costly when setting up a telecommunication system. Also periodic and running maintenance, like for instance cell planning, preparation of standardised roaming agreements and control functions is realised by means of software, and development of such software products requires resources like knowledge, organisation, time, service and not  
15 the least money. In practice, it is virtually impossible for a smaller entity operator to take part in the mobile telecommunications market, even though the small scale operator may be able to get the required authorisation from responsible governments that manage national licenses for telecommunication.

20 Prior art, like for example the European patent application EP 1 017 208 A2, discloses a communication system providing data and voice services to subscribers at mobile terminals. Dynamic IP address assignment as well as dynamic domain name server (DNS) updates are used. However, the addresses are assigned by an operator whereby the operator is taking active part in both controlling and administering the  
25 established telecommunication connections.

There is thus a need for an improved and simultaneously simplified technique for less costly, preferably pre-paid low cost telephony services, including both voice and data communication services, which are free from subscription. Moreover, a  
30 way is required for simpler and more efficient administration of established calls in

a telecommunication system. Billing systems of today for use in telecommunication are huge computer systems of considerable complexity.

### ***Summary of the invention***

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It is therefore an object of this invention to provide a simplified, but yet improved technique, in particular for searching and finding Voice over IP enabled mobile communication terminals. Another object is to make it possible for small-scale operators to initiate their activities and create a scalable and easily running business, which can be established in a reasonably short period of time and without overloading initial investments in time and money.

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The present invention alleviates the problems associated with prior art technology by means of an arrangement for relayed services in a mobile telecommunication system comprising:

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a plurality of mobile communication terminals, from which an established point-to-point connection either originates or terminates,

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the mobile communication terminals operating in a mobile packet switched communication network, such as a third generation general packet radio service network,

a global and universal interconnecting network, such as the Internet, at least one router, which bi-directionally provides a connecting bridge for transmission of data between the mobile packet switched communication network and the global and universal interconnecting network, characterised in that

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at least one Internet relay mobile Voice over IP (IRMV) server is provided in the a global and universal interconnecting network, in order to enable communication between mobile communication terminals so as to avoid the need for operator interference with the established point-to-point communication.

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The objects of the present invention are fully accomplished, and the here disclosed solution to the problems stated simplifies communication in comparison with prior art technology within the field of the invention.

5 Using VoIP (Voice over Internet protocol) encoding in the mobile communication terminals will make it possible to make phone calls in a way similar to that of so-called chatting over Internet. This type of calls can be made without an operator having influence or even knowledge about the data transfer. With operator is here meant the entity handling transmission of mobile communication terminal data  
10 communications, such as voice and data traffic.

Hereby, new promising business opportunities are created and possible simplified business models are made conceivable. Voice communication can be carried out via VoIP using the data communication mode of the mobile communication terminal,  
15 and the entity that establishes the connection between the calling party and the called party can be anyone having access to an ordinary web server. This means that the entity may be virtually anyone, or at least a large number of people in possession of knowledge for setting up a web server, but requiring relatively limited resources and investments for doing this.

20 Today, many companies supply fixed IP telephones, i.e. telephones including the client software that makes them Voice over IP enabled. The market for applications in the field is growing rapidly, although the market share at present is not greater than a few percent of the entire fixed telephony market. If charging schemes for  
25 traffic become more attractive, which they probably will as the competition grows tougher and tougher, a mobile version of VoIP will be deployed at an increasing pace. In particular for international distance calls this scenario is feasible, since it is obvious from recent history that fixed VoIP has had most success when considering intercontinental calls. In just a few years of time, the trend towards multimedia  
30 content accessible from mobile communication terminals and all communication traffic being based on packet switched transmission works in favour of the present

invention. Therefore, the question is not whether, but rather when the technology here disclosed will have great impact on general tele- and data communication and our everyday lives.

5     ***Brief description of the drawings***

The features, objects, and further advantages of this invention will become apparent by reading this description in conjunction with the accompanying drawings, in which like reference numerals refer to like elements and in which:

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Fig 1 schematically illustrates a Internet-based mobile VoIP voice communication system according to the present invention.

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Fig 2 is a flow chart depicting the general operational sequence when establishing a call using the principles in accordance with of the present invention.

Fig 3 shows a signalling scheme for managing retrieval of address information according to the present invention.

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Fig 4 shows a signalling scheme for establishing a connection for voice data distribution according to the present invention.

***Detailed description***

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The following description is of the best mode presently contemplated for practising the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of describing the general principles of the invention. The scope of the invention should be ascertained with reference to the issued claims.

For illustrative purposes, the following description is directed to a cellular radio communication system, but it will be understood that this invention is not so limited and applies to other types of communication systems. Such exemplary communication systems could be systems that utilise access technologies like WLAN, IR and Bluetooth.

With GPRS (general packet radio service) and other networks more clearly of the third generation, mobile communication terminals and networks will be able to handle data traffic in an efficient way. It is very likely that market forces will drive down prices for data traffic in comparison with current rates, and in particular when compared to rates for voice traffic. Mobile communication terminals are very much a small computer, and definitely represent a powerful tool for communication. Subscribers to third generation network services will always be requesting more coverage and higher data transmission rates. There will be a strong and persistent driving force in favour of gradually increasing data transmission rates, lowered tariffs and introduction of flat-rate fees for a certain predetermined bandwidth or transmission capacity.

With reference to Fig 1, a schematic illustration is shown of an Internet-based mobile VoIP telecommunication system. The system includes a plurality of mobile communication terminals 1-5 and a plurality of Internet relay mobile Voice over IP (IRMV) servers 10-12. Each of the mobile communication terminals 1-5 establishes a connection with either one of the IRMV servers 10-12, via a wireless data connection provided by any wireless data operator. As will be described in the following, the communication session does not have to go via the IRMV servers 10-12, but can take place between the mobile communication terminals also as an established peer-to-peer communication session.

In a near future, mobility of IP-addresses in a form of routing will be a functionality that the operator will charge its customers for, i.e. customers who subscribe to mobile communication services. When regarding the IP-addresses to be personal in-

stead of handled exclusively by the operators, a new way of viewing mobility is approaching and with it new and promising opportunities will emerge. The operator will be seen more as a provider of communication than a controller of communication.

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An Internet relay chat service provides a way of communicating by means of so-called chatting, which is a way of instant communication by typing messages on a keyboard. The messages are displayed in real time and people can take active part in the communication irrespective of their current location. The only condition is that they are on-line and have access to a certain virtual location for the communication activity, access to a so-called chat room. The Internet relay chat consists of various separate networks of IRC (Internet relay chat) servers including computer based applications that allow users to connect to the IRC server. Generally, users of a chat service run a computer program product called a client software in order to be connectable to a server in one of the IRC networks. The servers of the network relay information bi-directionally to and from other servers within the same network.

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The key idea is that the VoIP voice communication functions are partly implemented in the mobile communication terminals 1-5 and partly in the IRMV server 10-12. Alternatively, the functions are entirely implemented in the mobile communication terminals 1-5 with the IP-address register realised in the IRMV server 10-12. An example of this is that the mobile communication network of the operator, to which the communication terminal is connected, does not have information about the application used. As soon as the mobile terminal goes from turned off to idle mode, the application of the mobile terminal registers that the terminal is on-line with the defined IRMV server 10-12. The at least one involved IRMV server both sets up and controls the speech session and the path between the mobile communication terminals of the session. In another embodiment of the present invention, the ensuing session is established by and between the mobile communication terminals only, why the session can be described as a peer-to-peer session, and in response to this the IRMV servers must have made the search for the IP-address of the called

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party possible, and this search must have been made in advance. In a near future, the new Internet protocol IPv6 will be implemented, which will significantly influence assignment of dynamic IP-addresses. The new protocol will make the register keeping and look-up function simpler since the address space in the new protocol allows for longer address fields than the Internet protocol of today. Each mobile communication terminal 1-5, as well as every other terminal, will have its own fixed IP-address, whereby the register keeping and look-up function is made even unnecessary for known identities.

10 The present invention can be initiated at low intensity, and by means of a very limited initial investment. The "Internet relay chat" type of server (IRC server) application can establish a dedicated chat channel for two communication terminals, i.e. two persons communicating with each other. Transmitted chat messages contain voice traffic encoded as VoIP, in detail meaning voice traffic transmitted in the form of encoded packets, for instance in accordance with the H.323v2 protocols, for application in a third generation mobile communication terminal or terminals equipped with H.323v2 protocol functionality.

20 With reference to Fig 2, a flow chart is depicting the general operational sequence when establishing a call using the principles in accordance with of the present invention. The Internet and a general packet switched radio communication network, for instance 3G (third generation) or a GPRS (general packet radio service) network, are connected via routers 23, 24. Depending on their respective locations, mobile communication terminals 1, 2 communicate with different radio base stations (not shown) within the general packet switched radio communication network. Information is transmitted to the Internet via routers 23, 24 and from there to and from other routers 20-22 and to interconnected IRMV servers 10-12. A more detailed description of the signalling schemes will follow below with particular reference to Fig 3 and Fig 4.



An alternative embodiment is that the IP-address for the called mobile communication terminal as well as its status whether it is online, offline, idle or busy is determined via the IRMV server network, whereas the voice communication include voice packets and control signals. The mobile communication terminal of the calling party has a client application installed. The client application enables the search for the IP-address of the party to be called based on an identifier, such as name, telephone number possibly including country code, a unique identity number, etc. the unique identity number could be the fixed assigned IP-address. The IP sessions containing the call is outside of the IRMV server and is able to exist in another IP-based network, even within the public Internet or within a dedicated IP-based voice network. This location of the IP session depends of course on the quality requirements on established communications, the so-called quality of service (QoS). The client application running in the terminals could have a functionality that requests a new session (routing path) if quality of service deteriorates, possibly depending on transmission delay or unsatisfactory bit error rate. In this particular case, the IRMV server network is only used for searching and finding the IP-address of the party to be called. The IRMV servers co-operate in searches for IP-addresses using for instance standard methods similar to those of an Internet DNS (domain name server) network or a Gnutella type software, i.e. a combined software based search engine and file server where the file server is able to make various identifiers available for searching.

With reference to Fig 3, the operative sequence of establishing a call session is described. A mobile communication terminal being turned on, i.e. a switch of modes from turned off to idle mode is made. The mobile communication terminal with its installed IRMV client software connects to the Internet and is given a dynamic IP-address. Subsequently, and possible on user command, the IRMV client A application sends a message to the IRMV server A, which server may be handled by client A's operator, in order to register the client's dynamic IP-address in a way that others have the possibility of finding it, i.e. by name, telephone number or other unique identity number, such as fixed assigned IP-address. As previously mentioned, the

server may be handled by client A's operator, but this does not have to be the case. Also another entity may handle the IRMV more or less on behalf of the operator, possibly even on a franchise basis or other terms of licensing. The signalling sequence continues with an acknowledgement of the registration by client A's operator. Another client B registers its dynamic IP-address the same way, an address that is acknowledged by client B's operator accordingly. A query of client B's dynamic IP-address is made after the registration procedure of client A. The query is relayed from the client A by client A's operator to client B's operator from where the IP-address is forwarded to client A via client A's operator. Client B's dynamic IP-address would be delivered as a response to the query or search for client B's identifiers. After this signalling sequence, client A is aware of the dynamic IP-address of client B and the basic but still necessary requirements for a bi-directional communication session to be established have been fulfilled.

As soon as one of the subscribers wants to call another subscriber, he or she enters a command to the IRMV client application, such as mobile communication terminal, in order to make a call via the IRMV server network. The search procedure of the IRMV server is activated when searching for the IP-address of the other subscriber. As an alternative, also name, phone number or any other unique identification number can be searched for. If the client B is accessible, i.e. a match is found, an IP-address is delivered and a call session is initiated. This means a VoIP call has been established. It should be noted that a conference call, which is a call with at least three participants can be initiated in the same way as the above initiation of a call with only two participants.

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With reference to Fig 4, a signalling scheme is displayed for setting up a relayed communication connection according to the present invention, which is similar to that of a chat connection set-up. The sequence is initialised in that a message is transmitted from the client A's dynamic IP-address to the client B's dynamic IP-address saying that a VoIP communication session is requested to be established. The request message is transmitted from client A to client B via client A's and client

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B's IP network access routers 23, 24. After the message has been received by client B, the message is accepted and acknowledged. This acknowledgement message is transmitted back to client A via relay stations, i.e. access routers handled by the operators respectively in the communication network. After having been received, a  
5 relayed communication session is established between client A and client B, which direct communication session is relayed over the IP network access routers 23, 24. A subsequent call tear-down procedure is initiated either by the client A or client B IRMV application and is relayed in a corresponding way.

10 One of the important points to address, and a crucial hurdle that has to be overcome for succeeding in communication technology is the speech quality in relation to the price of a provided service. Software clients, i.e. units connected directly to the subscribers' mobile communication terminals also measure the quality of the session with regards to packet loss, packet delay and jitter. If the voice quality is below a  
15 certain level, which level may be defined and predetermined by the user, either of the clients signals to the other client or to the IRMV server that a new session has to be established with higher transmission quality. This could even result in a so-called public voice dedicated packet network, PVDPN, provided adequate transmission quality can not be delivered by changing routing path. By means of the present in-  
20 vention, the routing path can be exchanged to a new routing path with higher quality than the original path of poorer transmission quality. For improving the radio transmission quality, one of a plurality of tools to be utilised is the so-called Rocco protocol. However, improvement of transmission quality will not be further described in this document, and therefore reference is made to an article in the Ericsson Re-  
25 view No. 1, 2000, Göran AP Eriksson et al.

In yet another embodiment, the mobile communication terminals could be WLAN or Bluetooth enabled devices. The mobile communication terminals would then communicate with WLAN or Bluetooth hubs, which hubs are also generally referred  
30 to as access points (AP). An access point could be a stand alone device, even though it is of course connected to the Internet, or form part of a network of access points

connected to the Internet. In such an embodiment the access points could incorporate the previously described IRMV server functionality. A specific access point would in that case be in possession of IP-addresses, or alternatively names, telephone numbers or other unique identification numbers or fixed allocated IP-  
5 addresses of all terminals hosted by it, i.e. all terminals accessible from the specific access point. The IRMV server functionality of the access point would then be able to search for IP-addresses or other unique identifiers in the same way as described above. If the IRMV functionality incorporates a search engine as well as file sharing software (for example a so-called Gnutella client), the access point could search for  
10 IP-addresses on other access points and regular IRMV servers described in the above scenario and at the same time make the identification data available for searching by other access points or regular IRMV servers. An example is information content, such as a song would have a title, artist or record label, which are equivalent to the identifiers of for instance client B. Therefore, the procedure or  
15 searching for the IP-address of client B and the related VoIP session are very much like a bi-directional download of a song from the Internet. This is accordingly in analogy with the procedures when searching for content on the "Gnutella network". Referring to Fig 4, setting up a communication session is accomplished similar to establishing a chat connection with IRC functionality.

20 It will be appreciated by those of ordinary skill in the art that this invention can be embodied in other specific forms without departing from its essential character. The embodiments described above should therefore be considered in all respects to be illustrative and not restrictive. For example, although described above with reference to a GSM system employing a mobile communication terminal, the invention  
25 is also applicable in other types of communication systems.